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Clinical and laboratory findings in 60 cows with type-3 abomasal ulcer*

U. Braun¹, C. Gerspach¹, M. Hilbe², D.J. Devaux¹, C. Reif¹

¹Department of Farm Animals and ²Institute of Veterinary Pathology, Vetsuisse Faculty, University of Zurich

Summary

This study involved 60 cows aged 1.9 to 13 years (mean 4.8 ± 2.3 years) with type-3 abomasal ulcer. The most common clinical signs were, in decreasing order of frequency, partial or complete anorexia (98%), obtunded demeanour (95%), decreased skin surface temperature (78%), congested scleral vessels (73%), abdominal guarding (61%), tachypnoea (58%), fever (58%) and tachycardia (55%). One or more concomitant disorders were diagnosed in 86% of the cows. The most common abnormal laboratory findings were hypokalaemia (75%), shortened glutaraldehyde test time (46%) and hyperfibrinogenaemia (43%). The diagnosis of type-3 abomasal ulcer was made in all cows during laparotomy and/or at postmortem examination. Forty-eight (80%) cows were euthanased immediately after the initial examination, during laparotomy or after unsuccessful treatment. Twelve (20%) cows were treated with a solution of sodium chloride and glucose administered via an indwelling jugular catheter, antibiotics, metamizole or flunixin, and discharged from the clinic. Ten cows were still in production two years later.

Keywords: cattle, abomasum, type-3 ulcer, localised peritonitis

Klinische und labordiagnostische Befunde bei 60 Kühen mit Labmagenulkus Typ 3

Die vorliegende Untersuchung umfasst 60 Kühe im Alter von 1.9 bis 13 Jahren (4.8 ± 2.3 Jahre), die wegen eines Labmagenulkus Typ 3 untersucht wurden. Die häufigsten klinischen Befunde waren in abnehmender Reihenfolge stark reduzierte bis aufgehobene Futteraufnahme (98%), gestörtes Allgemeinbefinden (95%), kühle Körperoberfläche (78%), injizierte Skleren (73%), gespannte Bauchdecke (61%), Tachypnoe (58%), Fieber (58%) und Tachykardie (55%). Bei 86% der Kühe wurden eine oder mehr Begleitkrankheiten diagnostiziert. Als häufigste abnorme Blutbefunde wurden Hypokaliämie (75%), verkürzter Glutaltest (46%) und Hyperfibrinogenämie (43%) festgestellt. Die Diagnose eines Labmagenulkus Typ 3 erfolgte bei allen Kühen bei der Laparotomie und/oder der pathologisch-anatomischen Untersuchung. 48 Kühe (80%) wurden unmittelbar nach der Eintrittsuntersuchung, während der Laparotomie oder nach einem erfolglosen Therapieversuch euthanasiert. Bei 12 Kühen (20%) war die Therapie mit NaCl-Glukose-Lösung im Dauertropf, Antibiotika und Metamizol oder Flunixin meglumin erfolgreich. Zwei Jahre nach der Entlassung lebten noch 10 Kühe.

Schlüsselwörter: Rind, Labmagen, Ulkus Typ 3, lokale Peritonitis

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Introduction

Abomasal ulcers have been classified into four^{1,12,14,27,29} or five¹¹ types by different authors. Occasionally more than one ulcer type occurs at the same time.¹³ Type-1 abomasal ulcer is an erosion or a non-perforated ulcer accompanied by minimal haemorrhage. Type 2 ulcer is associated with severe intraluminal haemorrhage because of erosion of a large blood vessel, and type-3 ulcer is perforated and characterised by localised peritonitis. Type 4 ulcer denotes a perforated ulcer with generalised peritonitis caused by diffuse dissemination of ingesta in

the abdomen. A perforated ulcer accompanied by peritonitis within the omental bursa was previously considered a subtype of type 3¹⁵ but is now known as type-5 abomasal ulcer.¹¹ The clinical and laboratory findings of the various ulcer types vary widely and were described in detail in 145 cows with type-2 ulcer⁸ and in 87 cows with type-4.⁷ With type-3 ulcer, which is the topic of the present study, the perforation is located immediately adjacent to other visceral organs, the omentum or the peritoneum so that only a limited amount of abomasal content escapes and adhesions form because of local inflammation. The result of this process is localised

*Dedicated to Professor Karl Nuss on the occasion of his 60th birthday in appreciation of his outstanding and dedicated collaboration with the veterinary community

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peritonitis, occasionally complicated by abscessation. Clinical signs of type-3 abomasal ulcer are similar to those of traumatic reticuloperitonitis^{1,14,29} and include signs of abdominal pain, poor appetite, decreased ruminal motility, ruminal tympany and enlarged abdomen.²² Because abomasal haemorrhage is usually minimal with type-3 ulcer, melena is not a typical feature of this condition²⁹ even though 4 of 5 cows of another report had positive occult blood test results.²⁸ Not surprisingly, the haematocrit of cows with type-3 ulcer is normal.^{22,28} Hyperproteinaemia and hyperfibrinogenaemia are considered characteristic signs of chronic localised peritonitis and are often accompanied by a decrease in coagulation time in the glutaraldehyde test.⁵ Ultrasonography can provide additional information in cows with abomasal disorders but there are no published reports of the ultrasonographic diagnosis of abomasal ulcer.² Aspiration of blood during abomasocentesis is highly suggestive of abomasal ulcer.² Ultrasonographic findings of peritonitis vary widely⁶ but peritonic changes in the anterior abdomen are a suggestive of abomasal ulcer provided that traumatic reticuloperitonitis can be ruled out, for instance by the lack of a visible foreign body on radiographs of the reticulum. In contrast to type-2 ulcer, the diagnosis of abomasal type-3 ulcer is difficult. Type-3 abomasal ulcer should be suspected in herds that have an increased incidence of early-lactation cows with nonspecific clinical signs resembling traumatic reticuloperitonitis.²⁹ Other diseases associated with localised peritonitis such as traumatic reticuloperitonitis must be ruled out, which is aided by radiography and ultrasonography.⁶ However, a final diagnosis of type-3 abomasal ulcer can often not be made until an exploratory laparotomy is carried out²² or at postmortem examination.¹ There have been only two published reports of cows with type-3 abomasal ulcer, one of which involved 17 cows²² and the other five cows.² The purpose of the present study was to describe the clinical, laboratory and ultrasonographic findings of 60 cows with type-3 abomasal ulcer to facilitate the diagnosis of this disease.

Materials and Methods

Cows

This was a retrospective study of 60 cows that had a main diagnosis of type-3 abomasal ulcer. The cows had been admitted to the Veterinary Teaching Hospital, University of Zurich, from January 1, 1991 to December 31, 2014. The final diagnosis of type-3 abomasal ulcer was based on the results of laparotomy and/or postmortem examination. The results were described in detail in a dissertation.²⁴ The cows ranged in age from 1.9 to 13.0 years (mean \pm sd = 4.8 ± 2.3 years). Breeds included Brown Swiss (20), Holstein Friesian (20), Swiss Fleckvieh (19) and Jersey (1). The duration of illness was

< 2 days in 13 cows, 2 to 6 days in 29 cows, 7 to 14 days in 14 cows and > 14 days in 2 cows. The duration of illness was not recorded in 2 cows. The majority of cows (n = 34, 57 %) became ill within 4 weeks after calving. Cows in which the ulcer resulted in omental bursitis were not included in this study.

Clinical examination and laboratory analyses

The cows underwent a thorough clinical examination as described previously⁷. Blood samples were collected for the determination of haematocrit, total leukocyte count, concentrations of total protein, fibrinogen, urea, potassium and chloride, and for the glutaraldehyde clotting test and venous blood gas analysis. A urine sample was analysed in 57 cows using a test strip (Combur®, Roche, Basel) and a refractometer to measure specific gravity. A sample of rumen fluid was collected from 54 cows using a Dirksen probe and assessed for colour, odour, consistency and pH (data not shown). In addition, the methylene blue reduction time and the concentration of chloride were determined.

Ultrasonographic examination and abdominocentesis

Ultrasonographic examination was carried out in 46 cows as described.² The abdomen was scanned from the right abdominal wall and right flank, and also from the left side when left displaced abomasum was suspected. Abdominal fluid was detected in eight cows, aspirated under ultrasonographic guidance and analysed.³ The aspirated fluid was considered an exudate when at least one of the following criteria was met: specific gravity > 1.015, total solids > 30 g/l, cloudy and malodorous appearance and green discoloration.

Radiographic examination of the reticulum

A lateral radiographic view of the reticulum was taken in 24 cows as described.⁶

Laparotomy

Laparotomy was conducted in 46 cows; the abdomen was explored from the right flank in 27 cows because the results of clinical and ultrasonographic examination were nondiagnostic, and omentopexy was carried out in 17 cows with left or right displaced abomasum. One of the cows with left displaced abomasum underwent additional laparotomy from the left flank to excise an ulcer before repositioning of the abomasum and omentopexy, and another cow with left displaced abomasum underwent a second laparotomy in dorsal recumbency under general anaesthesia to excise the ulcer via a ventral midline approach. Ruminotomy was carried out in one other cow, and another had a caecotomy.

Diagnosis

A diagnosis of type-3 ulcer was made when exploratory laparotomy showed fibrinous adhesions between the abomasum and the peritoneum and a reticular foreign body could be ruled out, or when the ulcer was detected at postmortem examination.

Medical treatment and/or euthanasia

40 cows (66.6%) received medical treatment for 1 to 16 days (median 3.5 days). This included 10 to 70 litres of a solution containing 9 g sodium chloride and 50 g glucose per litre administered via an indwelling jugular vein catheter for 1 to 7 days (median 3 days) in 39 cows and penicillin G procaine (12,000 IU/kg body weight, Procacillin®, MSD Animal Health, Lucerne) or amoxicillin (7 mg/kg body weight, Clamoxyl®, Zoetis Schweiz) for 1 to 10 days (median 4 days) in 28 cows. Twenty-five

cows received 1 to 10 doses (median 4 doses) of metamizole (35 mg/kg body weight, Vetalgin®, MSD Animal Health), flunixin meglumine (1 mg/kg body weight, Flunixin®, Biokema, Crissier) or ketoprofen (3 mg/kg body weight, Rifen®, Streuli Pharma) administered intravenously.

Pentobarbital (Esconarkon, Streuli Pharma, Uznach, 80 mg/kg body weight) was administered intravenously when euthanasia was required immediately after the clinical examination, during laparotomy or after unsuccessful treatment.

Statistical analysis

The program IBM SPSS Statistics 22.0 was used for analysis. Frequencies were determined for each variable. The Wilk-Shapiro test was used to test the data for normality.

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Table 1: Clinical findings in 60 cows with type-3 abomasal ulcers

Variable	Finding	Number of cattle	%
Heart rate (n=60, median=84 bpm)	Normal (60 – 80)	27	45
	Mildly increased (81 – 100)	23	38
	Moderately increased (101 – 120)	9	15
	Severely increased (121 – 136)	1	2
Respiratory rate (n=60, median=28 breaths per min.)	Normal (16 – 25)	25	42
	Mildly increased (26 – 35)	13	22
	Moderately increased (36 – 45)	13	22
	Severely increased (46 – 72)	9	14
Rectal temperature (n=60, mean±sd=39.0±0.7 °C)	Normal (38.4 – 38.9)	13	22
	Decreased (37.5 – 38.3)	12	20
	Mildly increased (39.0 – 39.4)	23	38
	Moderately increased (39.5 – 40.0)	6	10
Rumen motility (n=59)	Severely increased (40.1 – 40.5)	6	10
	Normal	4	7
	Decreased	24	41
	Absent	29	49
Foreign body tests (n=59)	Hypermotility	2	3
	All negative	32	55
	Back grip positive ¹	23	39
	Pole test positive ¹	14	24
	Percussion of the reticulum positive ¹	10	17
Swinging and percussion auscultation on the left side (n=60)	At least one test positive	26	45
	Both negative (normal)	33	55
	Only percussion auscultation positive	5	8
	Only swinging auscultation positive	1	2
Swinging and percussion auscultation on the right side (n=60)	Both positive	21	35
	Both negative (normal)	32	53
	Only percussion auscultation positive	2	3
	Only swinging auscultation positive	7	12
Faeces (n=60)	Both positive	19	32
	Amount of feces decreased	39	65
	No faeces in the rectum	7	12
	Faeces watery to loose	14	23
Rectal findings (n=60)	Faeces dark to black	6	10
	Loss of negative pressure	12	20
	Rumen dilated	10	17
	Small intestine dilated	2	3
	Creptus	1	2

¹ Positive: at least 3 of 4 tests elicited a grunt

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Means \pm standard deviations were calculated for normal data (rectal temperature, haematocrit, total protein, fibrinogen, potassium, chloride) and medians for non-normal data (heart rate, respiratory rate, white blood cell count, urea, glutaraldehyde test time, pH, pCO₂, HCO₃⁻ and base excess of venous blood, urine pH, urine specific gravity). A value of $P < 0.05$ was considered significant.

Results

Clinical findings

The most common clinical findings were, in decreasing order of frequency, partial or complete anorexia (98%),

obtunded demeanour (95%), decreased skin surface temperature (78%), congested scleral vessels (73%), abdominal guarding (61%), tachypnoea (58%), fever (58%) and tachycardia (55%). In addition to abdominal guarding, manifestations of pain included bruxism in 18% and an arched back in 13% of the cows. Abdominal distension was seen in 18% of cows. Signs of colic did not occur in any cow. Rumen motility was absent in 49% of cows (Table 1). Of the foreign body tests, the back grip was positive in 39%, the pole test in 24% and percussion of the abdominal wall over the region of the reticulum in 17% of the cows. In 55% of the cows, all three tests were negative and in 45%, at least one foreign body test was positive. Swinging and/or percussion auscultation was positive on the left side in 45% of cows

Table 2: Haematological and blood biochemical findings in cows with type-3 abomasal ulcers

Variable (mean \pm sd or median)	Finding	Number of cattle	Percent
Haematocrit (%) (n=60, mean \pm sd=34 \pm 5.6%)	Normal (30 – 35)	29	48
	Decreased (14 – 29)	10	17
	Increased (36 – 48)	21	35
White blood cell count (/ μ l) (n=60, median=8,200/ μ l)	Normal (5,000 – 10,000)	38	63
	Decreased (2,500 – 4,999)	7	12
	Increased (10,001 – 32,300)	15	25
Total protein concentration (n=60, mean \pm sd=77 \pm 10.1 g/l)	Normal (60 – 80)	39	65
	Decreased (52 – 59)	2	3
	Increased (81 – 104)	19	32
Fibrinogen concentration (n=60, mean \pm sd=7.2 \pm 2.7 g/l)	Normal (4 – 7)	31	52
	Decreased (1 – 3)	3	5
	Increased (8 – 14)	26	43
Urea concentration (n=60, median=5.7 mmol/l)	Normal (2.4 – 6.5)	39	65
	Increased (6.6 – 21.5)	21	35
Potassium concentration (n=60, mean \pm sd=3.4 \pm 0.7 mmol/l)	Normal (4.0 – 5.0)	15	25
	Decreased (1.9 – 3.9)	45	75
Chloride concentration (n=59, mean \pm sd=97 \pm 10 mmol/l)	Normal (95 – 105)	27	46
	Decreased (69 – 94)	20	34
	Increased (106 – 116)	12	20
Glutaraldehyde test (n=59, median=10.0 min.)	Normal (10 – 15min.)	31	52
	6.1 – 9.9min.	9	15
	3.1 – 6.0min.	10	17
	\leq 3min.	8	14
	Prolonged (16 – 60min.)	1	2

Table 3: Venous blood gas analysis in cows with type-3 abomasal ulcers

Variable (mean \pm sd or median)	Finding	Number of cattle	Percent
pH (n=56) (mean \pm sd=7.41 \pm 0.1)	Normal (7.41 – 7.45)	14	25
	Decreased (7.30 – 7.40)	31	55
	Increased (7.46 – 7.57)	11	20
pCO ₂ (n=56) (median=44.5 mmHg)	Normal (35 – 45)	26	46
	Decreased (21.6 – 34.9)	4	7
	Increased (45.1 – 68.5)	26	46
HCO ₃ ⁻ (n=56) (median=25.7 mmol/l)	Normal (20.0 – 30.0)	39	70
	Decreased (18.8 – 19.9)	2	3
	Increased (30.1 – 51.7)	15	27
Base excess (n=56) (median=2.4 mmol/l)	Normal (-2 – +2)	21	38
	Decreased (-6.1 – -2.1)	7	12
	Increased (2.1 – 29.1)	28	50

and on the right side in 47%. There was little or no faeces in the rectum in 77% of cows. Faecal consistency varied from liquid to normal to drier than normal, and faecal colour was dark or black in 10% of cows. Transrectal examination showed abnormal findings in 29 cows including reduced or absent intraabdominal pressure in 20%, ruminal distension in 17%, distended loops of small intestine in 3% and crepitus in 2% of cows. Caecal dilatation or a displaced abomasum to the right side was palpated transrectally in another 7% of cows. Additional clinical findings were muscle tremors or droopy ears (7% each), spontaneous grunting and abducted elbows (5% each) and low head carriage and a sawhorse-like stance (2% each).

Laboratory findings (blood, urine, rumen fluid)

The most frequent haematological and biochemical abnormalities were, in decreasing order, hypokalaemia (75%), shortened glutaraldehyde test time (46%), hyperfibrinogenaemia (43%), haemoconcentration (35%), azotaemia (35%) and hyperproteinaemia (32%) (Table 2). Venous blood gas analysis showed a mild decrease in pH in 55% of 56 cows, increased pCO₂ in 46% and a positive base deficit in 50% (Table 3).

In 57 cows, urinalysis showed haematuria with macroscopically normal urine (5 to 250 erythrocytes per high-power field) in 37%, aciduria (pH < 6.5) in 32%, ketonuria (0.1 to 1.5 g ketone bodies/l) in 26%, glucosuria (0.5 to 10 g glucose/l) in 16% and proteinuria (1 to 1.5 g protein/l) in 5%. The urine specific gravity was decreased (1.000 to 1.019) in 46% and increased (1.042–1.050) in 9% of the cows.

The chloride concentration of rumen fluid was increased (26 to 66 mmol/l) in 63% of 54 cows.

Peritoneal fluid had inflammatory changes in 7 of 8 cows, was yellow in 3 cows, haemorrhagic in 4, cloudy

in 4 and malodorous in 1 cow. The specific gravity ranged from 1.020 to 1.040 (1.030 ± 8.0) and the protein concentration from 20 to 52 g/l (median 45 g/l).

Ultrasonographic findings

The reticulum was elevated from the ventral abdominal wall in 5 (20%) of 25 cows and had an abnormal contour in 3 (12%) of the cows (Table 4). The amplitude of reticular contractions was decreased in 6 (24%) of the cows, and 9 (36%) had reticular atony. Echogenic changes in the vicinity of the reticulum with or without fluid inclusions were seen in 10 (40%), free fluid in 5 (20%) and an abscess in 2 (8%) of the cows. Other findings were abomasal dilatation in 3 (11%) of 27 cows, left displaced abomasum in 16 (59%) and right displaced abomasum in 7 (26%) of the cows. Fibrinous adhesions of the abomasum and/or free fluid in the vicinity of the abomasum were seen in 11 (41%) of the 27 cows. The peritoneal fluid of 7 cows had evidence of inflammatory changes including echogenic deposits or strands or a heterogeneous appearance.

Radiographic findings of the reticulum

A penetrating reticular foreign body was detected radiographically in 2 (8%) of 24 cows, but this was determined to be an incidental finding in both cases during the subsequent postmortem examination.

Concomitant diseases

One (38%), two (33%) or three or more (15%) concomitant diseases were diagnosed in 86% of the cows including left or right displaced abomasum (63%), fatty liver syndrome (17%), fascioliasis (15%), metritis/endometritis (13%), ketosis (7%), mastitis (2%) and lameness (2%).

Diagnosis

A definitive diagnosis of type-3 abomasal ulcer could not be made in any of the cows based on clinical, ultrasonographic and laboratory findings. In 40% (n=24) of

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Table 4: Ultrasonographic findings in cows with type-3 abomasal ulcers

Location	Finding	Number of cows	Percent
Reticulum (n=25)	Elevated from ventral abdominal wall	5	20
	Contour abnormal	3	12
	Amplitudes of contraction decreased	6	24
	Reticular atony	9	36
	Echogenic changes with or without fluid inclusions	10	40
	Free fluid in reticular region	5	20
	Abscesses	2	8
Abomasum (n=27)	Dilated	3	11
	Left displacement	16	59
	Right displacement	7	26
	Fibrin deposits on serosa	5	19
	Free fluid in abomasal region	6	22

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the cows, the diagnosis was made during laparotomy based on adhesions between the abomasum and the peritoneum, and in the remaining 60% (n=36), it was made at postmortem examination.

Treatment, outcome and euthanasia

Eighty percent (n=48) of the cows were euthanased immediately after the initial examination (n=7), during laparotomy (n=22) or after unsuccessful treatment (n=19). Euthanasia was carried out when the results of clinical, laboratory or ultrasonographic examination indicated a poor prognosis, severe untreatable changes were found during laparotomy, or when adhesions between the abomasum and left side of the abdominal wall prevented reduction of concomitant left displacement of the abomasum. Other reasons for euthanasia included concurrent severe disease such as fatty liver syndrome or complicated sole ulcer that did not respond to treatment. In the remaining 20% (n=12) that had adhesions between the abomasum and the peritoneum, treatment was successful regardless of whether the adhesions could be broken down completely, partially or not at all. Of the 12 cows that were discharged, two had recurring abomasal type-3 ulcer; one was euthanased and the other died suddenly. Ten cows (17%) remained productive for at least two years after discharge.

Postmortem findings

Type-3 abomasal ulcer associated with localised and occasionally apostematous peritonitis was diagnosed in all cows that underwent pathological examination (Figures 1 and 2). Twenty (33%) cows also had type-1 ulcers, four (7%) had type-2 ulcers, six (10%) had acute type-4 ulcers and two (3%) had type-5 ulcers.

Discussion

In agreement with the findings of a recent report on cows with type-4 abomasal ulcers,⁷ which cause diffuse peritonitis, type-3 ulcers occurred predominantly in the first four weeks after calving.^{10,17,21,22,27} Of 145 cows with type-2 ulcer, which is associated with severe haemorrhage, 36% were diagnosed in the first four weeks of lactation.⁸ A recent review of ulcerogenic factors^{19,20} concluded that they consist of various stressors that act on cows in addition to the stress that surrounds parturition causing increased secretion of cortisol, hydrochloric acid and pepsin and decreased secretion of prostaglandin E.^{19,20} Owners of cows that had been slaughtered and diagnosed with abomasal ulcers were unable to identify definitive causative factors.¹⁸ The stress level acting on healthy cows during late pregnancy and the first month of lactation could be substantiated based on increased hair cortisol concentrations at the time of parturition^{4,9} and three weeks later.⁹ Prevailing stressors at this stage include the movement from the dry-cow pen to the lactating group,^{16,23} a ration change that favours the increased production of volatile fatty acids,²⁶ the start of lactation and a variety of typical postpartum disorders such as periparturient paresis, metritis, displaced abomasum, fatty liver syndrome, ketosis and other conditions.²⁰ Indeed, 86% of the cows of the present study had one or more concomitant diseases, of which left and right displaced abomasum were the most common, occurring in 38 (63%) cows. Abomasal ulcer should therefore be ruled out in cows in which displaced abomasum is accompanied by clinical signs of peritonitis. It is assumed that displaced abomasum is a sequel of abomasal ulcer.

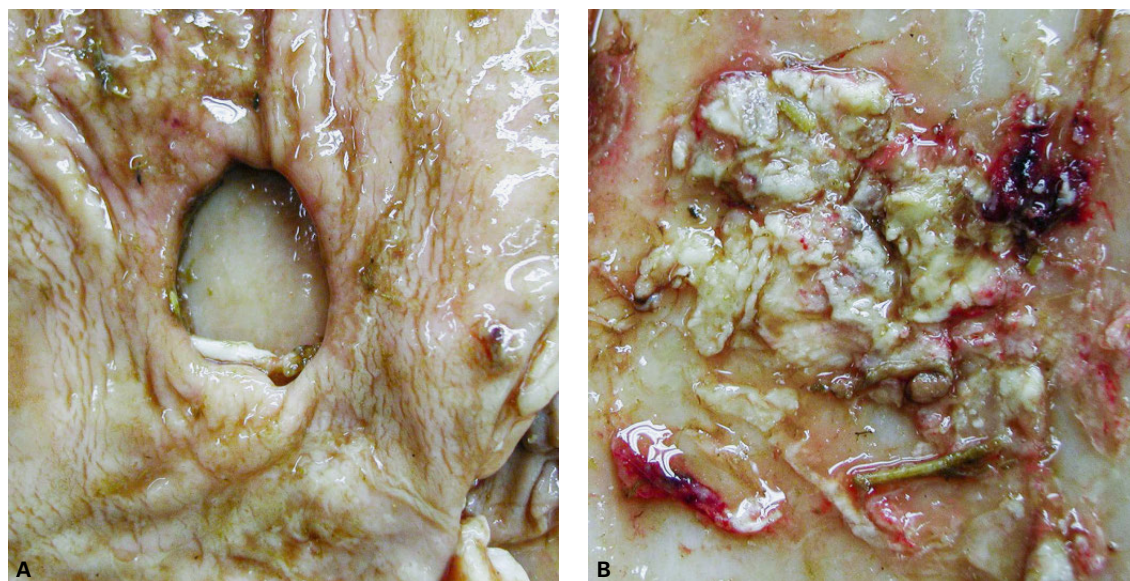


Fig. 1: Type-3 abomasal ulcer in a 7-year-old Holstein Friesian cow with left displaced abomasum. A Mucosal view showing perforated ulcer. B Serosal view showing fibrinopurulent material covering the ulcer.

The clinical presentation of type-3 abomasal ulcer was characterised by reduced feed intake, obtunded demeanour, reduced skin surface temperature, congested scleral vessels, abdominal guarding, tachypnoea, fever and tachycardia, which occurred in 98 to 55% of the cows of the present study. Clinical signs of cows with type-4 abomasal ulcer were similar,⁷ and in our experience, reliable differentiation of type-3 and type-4 ulcer is not possible based on clinical signs even though the signs are usually more severe in cows with the latter ulcer type. The frequency of manifestations of pain such as bruxism in cows with type-4 ulcers was similar to the frequency observed in the present study. Signs of colic, such as shifting of weight in the hind limbs, sunken back and kicking at the belly, were seen in 8% of cows with type-4 ulcers,⁷ but were not observed in the present study.

Of note, ruminal atony and positive foreign body tests were seen in only 49 and 45% of cows with type-3 ulcer, whereas the respective prevalences were 73 and 58% in cows with type-4 ulcer.⁷ The respective prevalences in cows with type-2 ulcer were 44 and 29%.⁸

The prevailing abnormal laboratory findings in the present study was hypokalaemia in 75% of cows. Hypokalaemia is common in cows with partial or complete anorexia because forage is the main source of potassium,²⁵ but also occurs in cows with metabolic alkalosis associated with abomasal reflux. Other causes of hypokalaemia have been described in detail.²⁵ Even though hypokalaemia occurred in 81 and 72% of cows with type-2⁸ and type-4 ulcers,⁷ the most important abnormal laboratory finding was a low haematocrit caused by haemorrhage in 82% of the cows with type-2 ulcer⁸, and haemoconcentration attributable to shock in 69% of cows with type-4 ulcer.⁷

Abdominal ultrasonography was not essential in diagnosing type-3 abomasal ulcer; the most common ultrasonographic finding was left displaced abomasum in 16 cows. Fibrin deposits on the abomasal serosa suggesting localised peritonitis were seen in only five cows, and in ten other cows, ultrasonographic evidence of inflammation in the reticular area was more suggestive of traumatic reticuloperitonitis than abomasal ulcer. In cows with type-4 ulcer,⁷ abdominal ultrasonography and abdominocentesis produced evidence of peritonitis in 65 (87%) of 75 cows but reticular changes – because of the close proximity between the abomasum and the reticulum – were also seen. A few cows with type-4 ulcer also had fibrin deposits on the abomasal serosa.

A diagnosis of type-3 ulcer could not be made in any cow based on clinical, ultrasonographic and laboratory findings, whereas a correct or a tentative diagnosis was

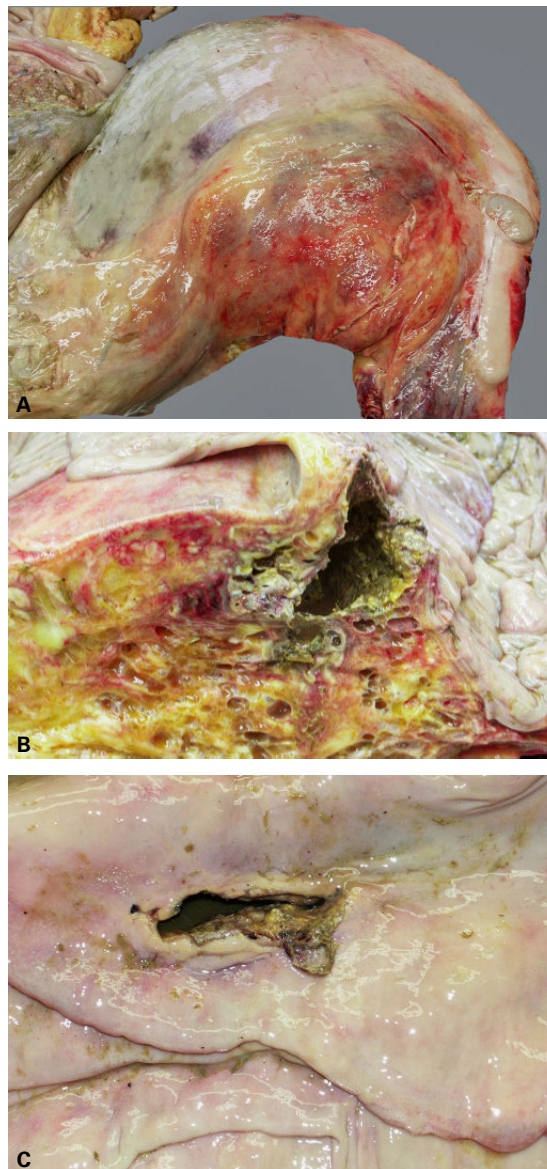


Fig. 2: Type-3 abomasal ulcer and abscess in a 7-year-old Swiss Fleckvieh cow with left displaced abomasum. A Serosal view showing a large mass with a haemorrhagic and partially gelatinous and yellowish surface at the lesser curvature. B Sagittal section of the abomasum including the mass identifying the latter as an abscess caused by a perforated ulcer. C Mucosal view showing perforated ulcer.

possible in 86% of cows with type-2 ulcer⁸ and in 76% of cows with type-4 ulcer.⁷ The reason for this discrepancy is that the clinical manifestations of type-3 ulcer are much less specific compared with type-2 and type-4 ulcers, which are characterised by gastrointestinal haemorrhage and anaemia, and generalised peritonitis and shock, respectively.

The 20% treatment success rate in cows with type-3 ulcer was closer to the success rate for type-4 (0%)⁷ than type-2 ulcer (67%)⁸. The relatively better prognosis for

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type-2 ulcer is not surprising because abomasal perforation does not occur. Of 17 cows diagnosed with type-3 abomasal ulcer during laparotomy, in which the adhesions were broken down when this was feasible without undue force, ten (59%) cows survived and seven were euthanased because the adhesions were too extensive or the abomasum ruptured during the procedure.²² Our own treatment success rate was considerably lower, but we surmise that it closely reflects the clinical reality.

Conclusions

The diagnosis of type-3 abomasal ulcer is difficult based on the results of clinical, ultrasonographic and laboratory examinations because none of these techniques detected characteristic pathognomonic signs. Clinical signs typical of reticuloperitonitis in early-lactation cows that fail to respond to treatment with a magnet are suggestive of type-3 abomasal ulcer.

Résultats cliniques et de laboratoire chez 60 vaches atteintes d'ulcère de la caillette de type 3

Cette étude portait sur 60 vaches âgées de 1,9 à 13 ans (moyenne de $4,8 \pm 2,3$ ans) atteintes d'un ulcère de la caillette de type 3. Les signes cliniques les plus fréquents étaient, par ordre de fréquence décroissante, une anorexie partielle ou complète (98%), un comportement apathique (95%), une diminution de la température de la peau (78%), des vaisseaux scléaux congestionnés (73%), une défense abdominale (61%) de la tachypnée (58%), de la fièvre (58%) et tachycardie (55%). Un ou plusieurs troubles concomitants ont été diagnostiqués chez 86% des vaches. Les résultats de laboratoire anormaux les plus fréquents étaient une hypokaliémie (75%), une durée réduite du test du glutaraldéhyde (46%) et une hyperfibrinogénémie (43%). Le diagnostic d'ulcère de la caillette de type 3 a été posé chez toutes les vaches au cours d'une laparotomie et/ou lors de l'examen post mortem. Quarante-huit (80%) des vaches ont été euthanasiées immédiatement après l'examen initial, pendant la laparotomie ou après un traitement infructueux. Douze (20%) vaches ont été traitées avec une solution de chlorure de sodium et de glucose administrée via un cathéter jugulaire à demeure, des antibiotiques, du métamizole ou de la flunixin et ont quitté la clinique. Dix de ces vaches étaient encore en production deux ans plus tard.

Mots-clés: bétail, caillette, ulcère de type 3, péritonite localisée

Risultati clinici e di laboratorio in 60 vacche con ulcera abomasale di tipo 3

Questo studio ha coinvolto 60 vacche di età compresa tra i 1,9 e 13 anni (media $4,8 \pm 2,3$ anni) affetti da ulcera abomasale di tipo 3. I segni clinici più comuni erano, in ordine decrescente di frequenza, anoressia parziale o completa (98%), condizioni generali degradate (95%), diminuzione della temperatura superficiale della pelle (78%), vasi sclerali congestionati (73%), parete addominale tesa (61%), tachipnea (58%), febbre (58%) e tachicardia (55%). Uno o più disturbi concomitanti sono stati diagnosticati nell'86% delle vacche. I risultati anormali più comuni in laboratorio sono stati ipopotassiemia (75%), riduzione del tempo di test glutaraldeide (46%) e iperfibrinogenemia (43%). La diagnosi di ulcera abomasale di tipo 3 è stata posta in tutte le vacche durante una laparotomia e/o durante l'esame post mortem. Quarantotto (80%) vacche sono state eutanasiate immediatamente dopo l'esame iniziale, durante la laparotomia o dopo un trattamento senza successo. Dodici (20%) vacche sono state trattate con una soluzione di cloruro di sodio e glucosio somministrata attraverso un catetere giugulare permanente, antibiotici, metamizolo o flunixin e dimesse dalla clinica. Dieci vacche erano ancora in vita due anni dopo.

Parole chiave: bovini, abomaso, ulcera di tipo 3, peritonite localizzata

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Corresponding author

Ueli Braun
Department of Farm Animals, Vetsuisse Faculty, University of Zurich
Winterthurerstrasse 260
CH-8057 Zurich
Telephone: +41 52 7 41 50 60
E-Mail: ueli.braun@uzh.ch